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A misconception as to the structure of the ear of maize

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(WITH SIX TEXT FIGURES)

It is a fact of common knowledge and general interest that the rows of an ear of corn regularly occur in even numbers. By the layman this has usually been regarded as one of Nature's curiosities, not necessarily to be explained in any way; but the botanist long ago found it to be the expression of a morphological characteristic of the whole tribe (Maydeae) to which maize belongs.

Ordinarily the spikelets in all parts of both inflorescences of the maize plant are borne in pairs, one sessile and the other pedicelled. The fundamental structural unit of the ear of corn is a row of these paired spikelets, or, in other words, a pair of rows of grains, each spikelet producing one grain. As a rule there is no ascertainable difference between the two grains produced in a pair of spikelets, but there is abundant evidence that the sessile spikelets are responsible for one row and the pedicelled ones for the other.

It often happens that an ear has more rows at the base than at the tip, the difference in number being always two or a multiple of two. When the difference in number is two, both rows are dropped at exactly the same distance from the base of the ear; if the difference is more than two, two rows may be dropped at one distance from the end of the ear, two at another, and so on. Thus, no part of the ear is ever left with an odd number of rows.

The natural inference has been that these irregularities are due to the discontinuance of one or more rows of paired spikelets, an explanation apparently in harmony with most facts and theories centered in this unique structure. It is somewhat surprising, therefore, to find in connection with a recent theory* as to the origin of the ear of maize, a new explanation of this irregularity in the rows.

* Collins, G. N. Structure of the maize ear as indicated in *Zea-Euchlaena* hybrids. Jour. Agr. Research 17: 127-135. pl. 16-18 + f. 1. 1919.



FIG. 1. An ear with eighteen rows at the base and ten at the tip.

Just what technique was employed in securing this anomalous bit of evidence is not explained, except that many ears are said to have been examined, and reference is made to tassels having pistillate portions. In external appearance, an ear of corn is a very deceptive thing, and peculiar technique is sometimes necessary to bring out its true structure. The semblance of rows on the surface, being largely due to the adjustment of crowded units to their allotted space, may often be more properly regarded as geometrical rather than morphological, especially when any structural peculiarity is concerned (FIG. 1).

A reliable technique to bring out the arrangement of the spikelets, when any irregularity is evident, may be borrowed from the maker of corncob pipes. The first step in the process, after the removal of the kernels, is to shave off with a sharp knife the chaff on the outside of the cob.

A cardinal point in Collins's new theory of the origin of the ear is that each pair of spikelets is yoked structurally with another pair on the opposite side of the ear; and the statement is made (pp. 133-134) that a reduction in the number of rows between the base and the tip of the ear is due not to the discontinuance of a row of pairs of spikelets, but to the loss of the pedicelled spikelets from yoked pairs for a part of the length of the ear. No criticism of the general bearing of the theory is intended here, but the corollary statement as to the manner of the loss of rows cannot go unchallenged.

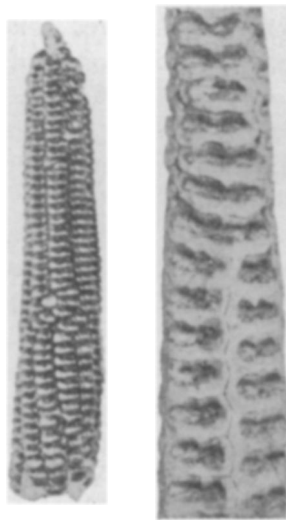
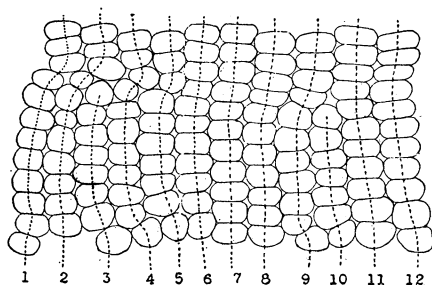


FIG. 2. An ear of corn with ten rows at the base and eight at the tip, $\times \frac{1}{2}$. FIG. 3. The cob of the ear shown in FIG. 2, after treatment as described in the text, $\times 1\frac{1}{2}$.

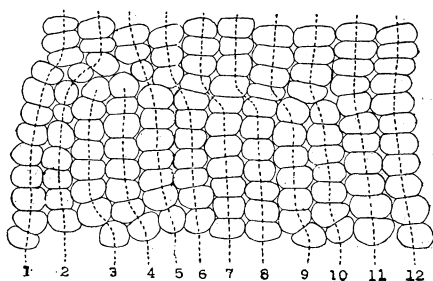
This chaff consists of the glumes and palets of the spikelets, and its removal exposes the alveoli, in each of which a pair of spikelets is borne. When these alveoli are brought out clearly, the work may be finished with a piece of sandpaper, but this is usually unnecessary. Any corncob, typical or anomalous, when treated in this way, displays a number of longitudinal series of alveoli corresponding to the rows of paired spikelets.

The results secured when this method is applied to an ear having more rows at the base than at the tip are best explained by reference to the figures. Fig. 2 is an ear of flint corn with ten rows at the base and eight at the tip; four rows are seen apparently giving place to two near the middle of the ear. If this change occurs as Collins explains it, we should find on the cob of this ear five rows of alveoli running full length; but FIG. 3, which shows a portion of the cob of this ear treated as above described, shows the fallacy of this theory. There are five rows of alveoli at the base and four at the tip, the change in number occurring at the exact point where two rows of grains are dropped.

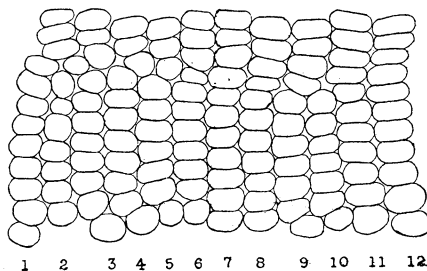
These results were duplicated with several ears, no ear being found



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5



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FIG. 4. Transition from twelve to ten rows.
FIG. 5. The erroneous explanation of FIG. 4; the dotted lines indicate the continuity of rows.
FIG. 6. The correct explanation of the transition indicated in FIG. 4.

that gave contrary results; particularly striking results were obtained with an ear having ten rows at one end and eighteen at the other (FIG. 1). The evidence is conclusive that the difference in number of rows is due to the discontinuance of a row of pairs of spikelets and not to the abortion of the pedicelled spikelets of two such rows.

FIGS. 4-6 show, in a composite camera lucida drawing, a belt around an ear, covering the point of transition from twelve rows to ten. The structure of the ear shows that 1 and 2, 3 and 4, 5 and 6, etc., are respective pairs of rows. FIG. 5 shows Collins's interpretation of the loss of rows, if this is a case where the location of rows can be determined with what he calls "reasonable certainty" (p. 134); rows 3 and 10, representing the pedicelled spikelets of their respective pairs, are dropped. But the method here described removes all doubt and is applicable to all ears regardless of their external aspect. It shows, as in FIG. 6, that the two rows lost constitute one pair.

It is probably incorrect to speak of the "loss" of rows except as an event incident to our progress in examining the ear from one end to the other, for the actual *loss* of rows in this case is probably not a fact of either phylogeny or ontogeny. There is nothing to indicate that the short rows represent long rows partially aborted. In fact the abortion of spikelets or of rows in the ear seems to be much more constant as a characteristic of theories demanding it for consistency than of real ears of corn; and the integrity of the pair of pistillate spikelets seems to be maintained quite as constantly in maize as is the abortion of one of the pair in teosinte.

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